

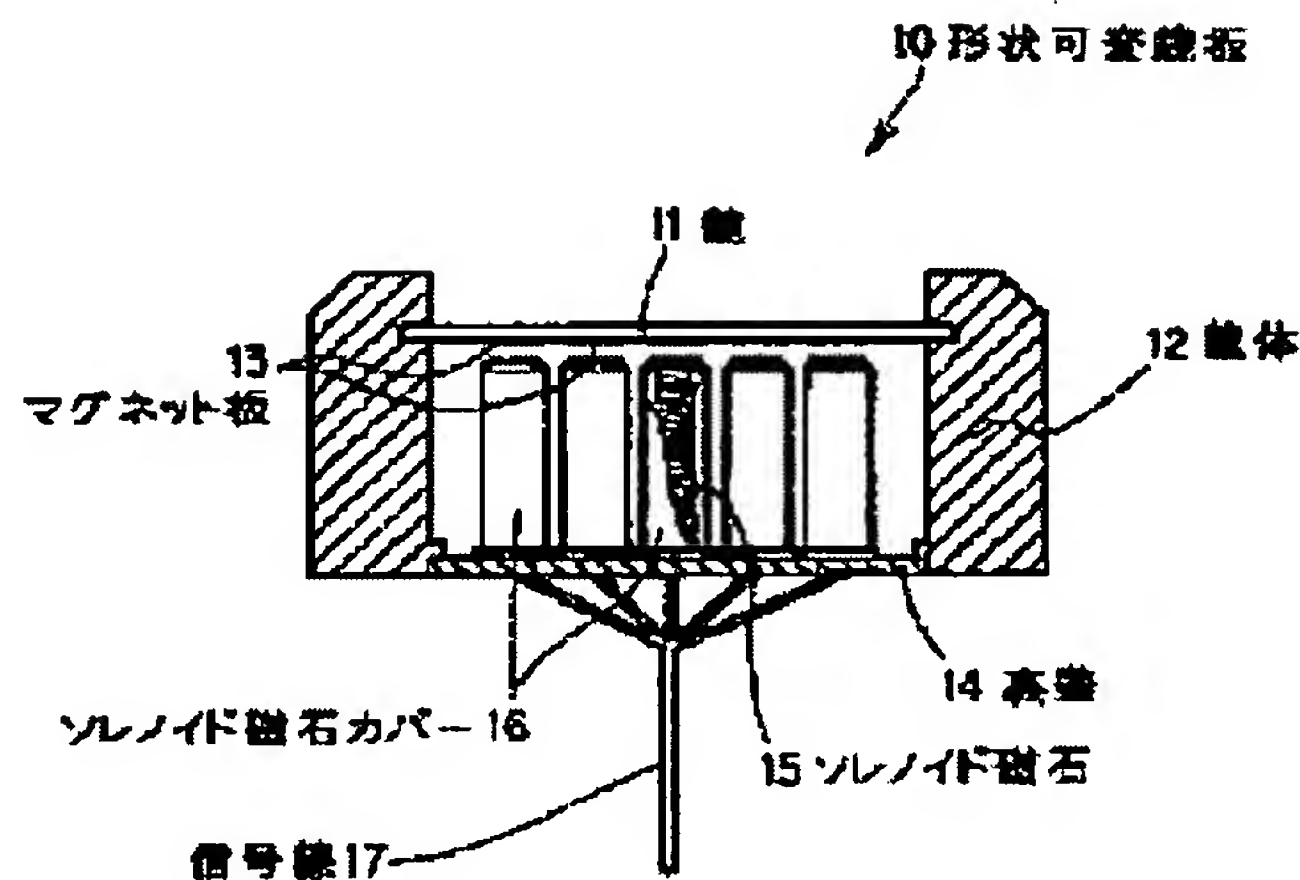
## SHAPE VARIABLE MIRROR

**Publication number:** JP8334708  
**Publication date:** 1996-12-17  
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**Classification:**  
- **International:** G02B26/00; G02B26/00; (IPC1-7): G02B26/00  
- **European:**  
**Application number:** JP19950141588 19950608  
**Priority number(s):** JP19950141588 19950608

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### Abstract of JP8334708

**PURPOSE:** To drive a shape variable mirror with a low voltage while the driver is of a non contacting type by forming the mirror with magnetic plates fitted on the back face of the mirror and with solenoid magnets oppositely arranged with gaps with respect to magnetic plates. **CONSTITUTION:** A mirror 11 is a disk-shaped copper mirror having flexibility and the peripheral edge of the mirror is supported by a case body 12. Plural magnetic plates 13 are fitted on the back face of the mirror 11. The opening of the other plane of case body 12 is covered with a rear lid 14. Moreover, in the inside of the case body 12, plural solenoid magnets 15 are provided on the rear lid 14 by being fixed and respective magnets 15 are covered with magnetic covers 16. Further, upper end planes of these solenoid magnets 15 are opposed to magnetic plates 13 with gaps. Thus, electromagnetic forces are generated by flowing currents in the solenoid magnets 15 and the mirror surface is deformed because the solenoid magnets 15 attract and repulse magnetic plates 13 fitted on the mirror 11.



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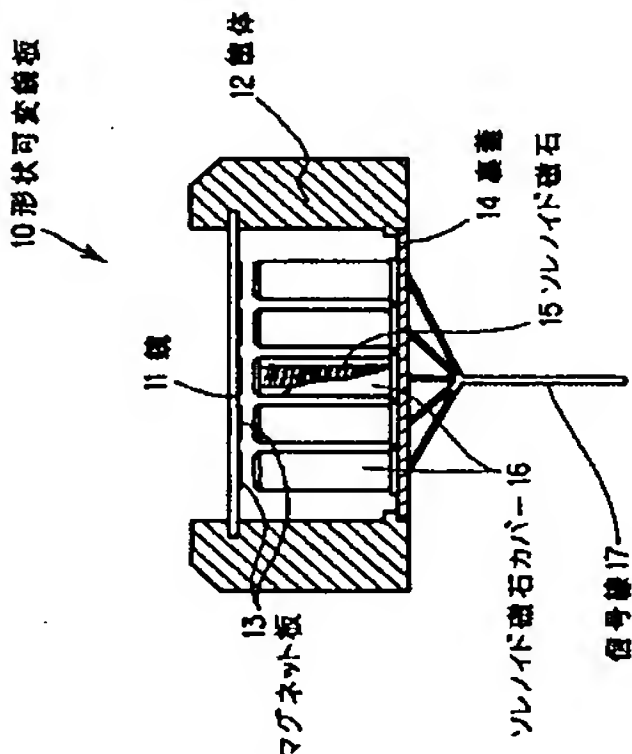
(51)Int.Cl. G 0 2 B 26/00	識別記号 G 0 2 B 26/00	庁内整理番号 F 1 G 0 2 B 26/00	技術表示箇所
審査請求 未請求 請求項の数1 OL (全 3 頁)			

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(54)【発明の名称】 形状可変鏡

(57)【要約】

【目的】 低電圧でも駆動のできる形状可変鏡を得る。  
【構成】 鏡11は可撓性を有し、筐体12で支持されている。鏡11の下面にはマグネット板13が取り付けられている。筐体12内にはソレノイド磁石15が備えられている。信号線17を介してソレノイド磁石15に電流を流すと電磁力によりマグネット板13が吸引・反発され、鏡11が変形する。



(2) 1

(2) 2

特開平8-334708

【特許請求の範囲】  
【請求項1】 周縁が筐体に支持された可撓性を有する鏡と、この鏡の裏面に取り付けられたマグネット板と、前記筐体内に備えられると共に前記マグネット板に対して間隔をあけて対向配置されたソレノイド磁石とでなることを特徴とする形状可変鏡。  
【発明の詳細な説明】  
【0001】  
【産業上の利用分野】 本発明は光学機器に適用される形状可変鏡に関し、非接触型でありながら駆動に要する電圧が低くてすむように工夫したものである。  
【0002】  
【従来の技術】 光学機器には形状可変鏡 (Deformable Mirror, Active Mirror: 「位相補正鏡」、 「能動鏡」とも呼ぶ) が用いられることがある。従来の形状可変鏡としては、駆動素子と鏡を直接取り付けた直付け型 (図2～図5参照) と、鏡と駆動素子が直接には取り付けられていない非接触型 (図6参照) とがある。  
【0003】 更に詳述すると、図2に示す形状可変鏡では、ベース1に備えた各駆動素子2の上端部に、剛性を有する鏡3をそれぞれ取り付けられている。駆動素子2は、図中上下方向 (矢印A方向) に伸縮する素子であり、具体的にはピエゾ素子、電歪素子、油圧/電動アクチュエータなどを用いることができ、この中ではピエゾ素子を用いることが多い。  
【0004】 図3に示す形状可変鏡では、1つの鏡3に対して2つの駆動素子2a、2bを取り付けており、駆動素子2a、2bの伸び長を異ならせることにより、鏡3をベース1に対して傾斜させることができる。  
【0005】 図4に示す形状可変鏡では、鏡3aは可撓性を有しており、各駆動素子2の伸び長を異ならせることにより、鏡3aの鏡面形状を連続的に変化 (鏡ませて変化) させることができる。  
【0006】 図5に示す形状可変鏡では、可撓性を有する鏡3aの裏面に突出部4を備えており、隣接する突出部4どうしを連結する状態で駆動素子2が配置されている。この例では、駆動素子2を伸縮させることにより鏡3aの鏡面形状を連続的に変化させることができる。  
【0007】 図6に示す形状可変鏡は非接触型であり、特に静電型と呼ばれている。この例では、可撓性を有する鏡3aの周縁は筐体5で支持されており、筐体5内には、駆動素子となる電極6が配置されている。そして各電極6は、鏡3aの裏面に対して間隔をあけて対向している。そして電極6に電圧をかけると、電極6と鏡3aとの間で生じる静電気が駆動力となって、鏡3aの鏡面形状が変化する。なお図6に示す非接触型の形状可変鏡では、接触型 (図2～図5) と異なり、取付部がないため、鏡の軽量化が達成でき、また、歪の少ない鏡面を得ることができる。

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【0008】  
【発明が解決しようとする課題】 ところで図2～図5に示す直付け型の形状可変鏡では、鏡3、3aと駆動素子2、2a、2bの間を機械的に取り付ける必要があるため、形状可変鏡全体の重量増を招いたり、取付の際に鏡3、3aに歪みを与える等の問題があった。  
【0009】 一方、図6に示す静電型と呼ばれる非接触型形状可変鏡では、電極6と鏡3aの間の静電気を駆動力として用いているため、比較的高い電圧 (数百～数千ボルト) が必要で扱いが難しかった。  
【0010】 本発明は、上記従来技術に鑑み、非接触型でありながら低電圧で駆動することのできる形状可変鏡を提供することを目的とする。  
【0011】  
【課題を解決するための手段】 上記課題を解決する本発明の構成は、周縁が筐体に支持された可撓性を有する鏡と、この鏡の裏面に取り付けられたマグネット板と、前記筐体内に備えられると共に前記マグネット板に対して間隔をあけて対向配置されたソレノイド磁石とでなることを特徴とする。  
【0012】  
【作用】 本発明では、ソレノイド磁石に電流を流すことにより、電磁力が発生し、鏡に装着されたマグネット板と吸引・反発することにより、鏡面を変形させることができる。  
【0013】  
【実施例】 以下に本発明の実施例を図面に基づき詳細に説明する。図1は本発明の実施例に係る形状可変鏡10を示す。同図に示すように、鏡11は可撓性を有する円板状の銅ミラーであり、その周縁は筐体12で支持されている。鏡11の裏面 (図では下面) には複数のマグネット板13が取り付けられている。筐体12の下面開口は蓋14で塞がれている。更に筐体12の内部では、複数のソレノイド磁石15が蓋14に固定されて備えられており、各ソレノイド磁石15はソレノイド磁石カバー16で被覆されている。これらソレノイド磁石15の上端面は、間隔をあけてマグネット板13に対向している。また、各ソレノイド磁石15には、信号線17を介して外部から個別に電流が流れるようになっている。  
【0014】 かかる構成となっている本実施例では、外部から信号線17を介してソレノイド磁石15に電流を流すと電磁力が発生し、この電磁力によりマグネット板13に対し反発力や吸引力が発生する。つまり電流を一方 (正方向) に流すと反発力が生じ、電流を他方 (負方向) に流すと吸引力が生じる。このように、マグネット板13が反発・吸引されることにより鏡11の鏡面が変形する。鏡11の変形方向及び変形量は、ソレノイド磁石15に流す電流の方向及び電流量を変えることにより制御できる。

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【0015】 ところで、実施例の形状可変鏡10を駆動す

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るのに必要となる電圧について試算する。鏡11は直径10cm、厚さ1mmの銅ミラーとし、この鏡11の中央部を20μmだけ変位させるものとする。このとき必要となる力は鏡11の周辺を固定している場合、5Nである。マグネット板13として、磁束密度0.6Wb/m/m、直径1.0cm、厚さ2.0mmのアルニコ磁石を用い、ソレノイド磁石15として、巻き数1000、コイル直径1.0cm、抵抗2.8Ωの銅ソレノイドを用いると、5Nの力を得るにはマグネット板13とソレノイド磁石15の間隔を0.1mmとした場合、ソレノイド磁石15に印加する必要電圧は2.8Vとなる。

【0016】これに対し、図6の静電型の形状可変鏡の場合では、電極6を半径0.5cmの銅とすると、電極間の間隔を30μmとして、5Nの静電力を得るための必要電圧は3600Vとなり、ソレノイド磁石に比べ、大きな電圧が必要となる。

【0017】なお上記実施例ではマグネット板13やソレノイド磁石15を複数備えたが、これら部材は1つであってもよい。

【0018】

【発明の効果】本発明では鏡の形状を変形させるために、ソレノイド磁石の電磁力を用いている。ソレノイド磁石の電磁力は少ない電圧で大きな力を発生することができるため、従来の例である静電型の形状可変鏡で問題となる高電圧を使用する必要がない。よって、高電圧電

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源を用意する必要がなく、また安全面でも優れる、取り扱いやすい形状可変鏡を実現できる。

【図面の簡単な説明】

【図1】本発明の実施例に係る形状可変鏡を示す構成図。

【図2】直付け型の従来の形状可変鏡を示す構成図。

【図3】直付け型の従来の形状可変鏡を示す構成図。

【図4】直付け型の従来の形状可変鏡を示す構成図。

【図5】直付け型の従来の形状可変鏡を示す構成図。

【図6】非接触型の従来の形状可変鏡を示す構成図。

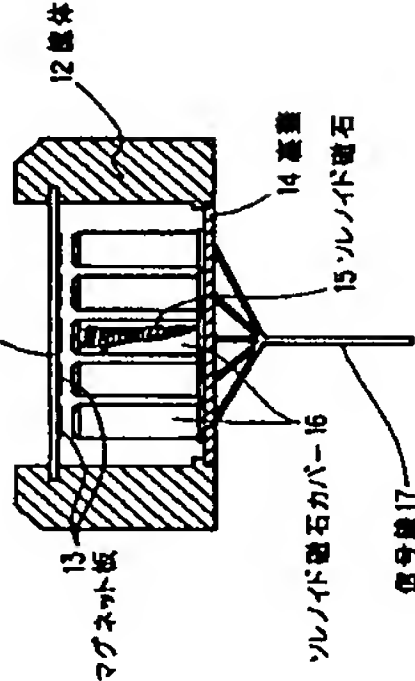
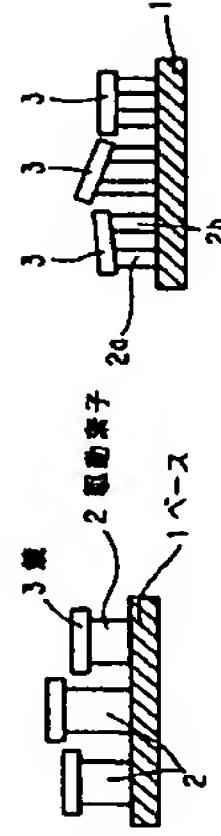
【符号の説明】

- 1 ベース
- 2, 2a, 2b 駆動素子
- 3, 3a 鏡
- 4 突出部
- 5 筐体
- 6 電極
- 10 形状可変鏡
- 11 鏡
- 12 筐体
- 13 マグネット板
- 14 蓋蓋
- 15 ソレノイド磁石
- 16 ソレノイド磁石カバー
- 17 信号線

【図1】

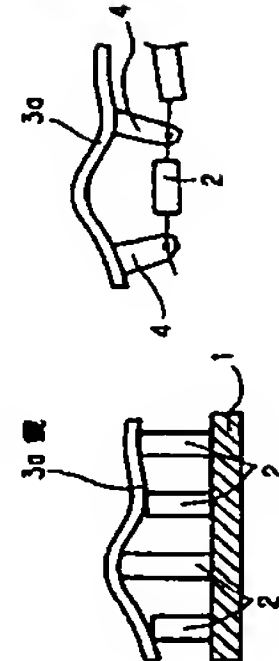
【図2】

【図3】

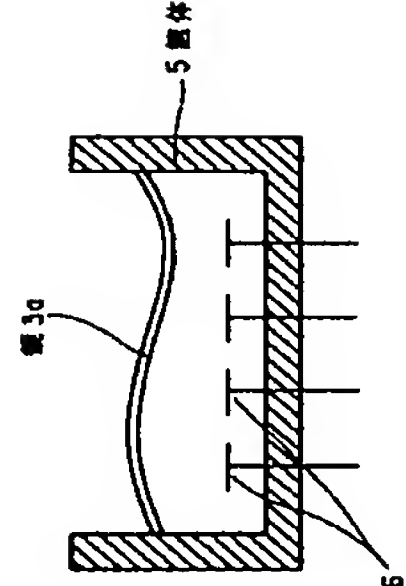


【図4】

【図5】



【図6】



## THE DETAILS OF THE FIRST OFFICE ACTION

The present application relates to an optical head for recording/reproducing the information into/from a light recording medium. Through examination, the detailed opinions are provided as follows.

### CLAIM REJECTIONS

(1) Claims 1, 2 and 17 are not in conformity with Article 22(2) of the Chinese Patent Law for lack of novelty, and claims 10, 11, 13-28 are not in conformity with Article 22(3) of the Chinese Patent Law for lack of inventiveness.

*Article 22(2): Novelty means that, before the date of filing, no identical invention or utility model has been publicly disclosed in publications in the country or abroad or has been publicly used or made known to the public by any other means in the country, nor has any other person filed previously with the Patent Administration Department Under the State Council an application which described the identical invention or utility model and was published after the said date of filing.*

*Article 22(3): Inventiveness means that, as compared with the technology existing before the date of filing, the invention has prominent substantive features and represents a notable progress and that the utility model has substantive features and represents progress.*

1. Claim 1 seeks to protect a deformable mirror. The cited reference 1 (JP 特开平 8-334708A) relates a deformable mirror, specifically disclosing the following technical features (referring to the paragraphs 13-17 in the specification of the cited reference 1, see Fig. 1): the deformable mirror 10 includes a deformable reflection mirror 11 (corresponding to the reflection mirror of claim 1), the deformable reflection mirror 11 is comprised of an upper reflecting plane for reflecting light and a magnetizing plate 13 (corresponding to the strong magnetic member of claim 1) having strong magnetic, wherein the magnetizing plate is disposed on an opposite surface of the reflecting plane (corresponding to a part of section of claim 1); a solenoid magnet 15 (corresponding to the switching device of claim 1) comprises an iron block (corresponding to the hard magnetic member of claim 1) inside the solenoid magnet and a solenoid (corresponding to the magnetizing member of claim 1) wrapping around the outside of the iron block, wherein the solenoid magnetizes the iron block upon being powered on and demagnetizes the iron block upon being powered off, the solenoid magnet 15 attracts the magnetizing plate 13 upon being powered on so that the deformable



reflection mirror 11 deforms, while the solenoid magnet 15 restores the deformable reflection mirror to the non-deformed state, both of the above solenoid magnet 15 and magnetizing plate 13 may have one in number. As apparent from the above, all technical features of claim 1 have been disclosed in the cited reference 1, the technical solution defined in claim 1 is substantially the same as the technical solution disclosed in the cited reference 1, and both technical solutions pertain to the same technical field, solve the same technical problem and have the same expected effect. Thus, claim 1 does not possess novelty in respect of the cited reference 1, which is not in conformity with Article 22(2) of the Chinese Patent Law.

2. Claim 2 is a dependent claim of claim 1. The additional technical features of claim 2 reside in that "the hard magnetic member is magnetized by the magnetizing member and attracts the strong magnetic member in the reflection mirror to make the reflection mirror to be the deformed state, and the hard magnetic member is demagnetized by the magnetizing member to restore the reflection mirror to the non-deformed state". The additional technical features have been disclosed in the cited reference 1 (refer to the paragraphs 14 and 17 in the specification of the cited reference 1, see Fig. 1), therefore, claim 2 is also not in conformity with Article 22(2) of the Chinese Patent Law for lack of novelty, in the case that claim 1 does not possess novelty.

3. The additional technical features of claim 10 reside in that "the reflection mirror includes a substrate which is made of a glass plate, at least a portion of the substrate is provided with the strong magnetic member". For the technical solution of claim 10 referring to claim 1 or 2, since the cited reference 1 has disclosed (refer to the paragraphs 13-17 in the specification of the cited reference 1, see Fig. 1) that the magnetizing plate 13 is provided on the substrate of the reflection mirror 11 and the glass plate is a common material used for the substrate of the reflection mirror in the art, it is obvious for those skilled in the art to obtain the technical solution of claim 10 in respect of the cited reference 1 in the case that claim 1 or 2 does not possess novelty. Therefore, claim 10 is not in conformity with Article 22(3) of the Chinese Patent Law for lack of inventiveness.

4. The additional technical feature of claim 11 resides in that "the reflection mirror uses a strong magnetic sheet material as the substrate". For the technical solution of claim 11 referring to claim 1 or 2, it is easily anticipated by those skilled in the art without involving inventive steps that a strong magnetic material is directly used as the substrate in order to make the attractive force stronger. Therefore, in the case that claim 1 or 2 does not possess novelty, it is obvious for those skilled in the art to obtain the above technical solution of claim 11 with reference to the cited reference 1, thus claim 11 is not in conformity with Article 22(3) of the Chinese Patent Law for lack of inventiveness.

5. Claim 13 is a dependent claim of claim 10 or 11. The additional technical feature of claim 13 resides in that "the reflecting plane is comprised of a reflective coating layer forming on a surface of the substrate". It is obvious for those skilled in the art to obtain the above technical solution of claim 13 with reference to the cited reference 1 in the case that the technical solution of claim 13 referring to claim 10 or 11 does not possess inventiveness, because the additional technical feature of claim 13 is a well known technique for those skilled in the art. Therefore, claim 13 is not in conformity with Article 22(3) of the Chinese Patent Law for lack of inventiveness.

6. Claim 14 is a dependent claim of claim 13. The additional technical feature of claim 14 resides in that "the reflective coating layer is comprised of an insulating multilayer film". It is easily appreciated by those skilled in the art to employ the insulating multilayer film to form the reflective coating layer in order to achieve a high reflectivity. Therefore, in the case of the technical solution of claim 13 does not possess inventiveness, it is obvious for those skilled in the art to obtain the above technical solution of claim 14 in respect of the cited reference 1, thus claim 14 is not in conformity with Article 22(3) of the Chinese Patent Law for lack of inventiveness.

7. Claim 15 is a dependent claim of claim 13 or 14. The additional technical feature of claim 15 resides in that "the reflective coating layers are respectively coated on both surfaces of the substrate". Claim 16 is a dependent claim of claim 13 or 14. The additional technical features of claim 16 reside in that "one surface of the substrate is coated with the reflective coating layer, and the other surface of the substrate is coated with a back side film which has the same thermal expansion rate as that of the reflective coating layer". In order to achieve the deformable reflection mirror having a good thermal expansion performance, it is easily appreciated by those skilled in the art that both surfaces of the substrate are coated with the same reflective coating layers; or one surface of the substrate is coated with a reflective coating layer and the other surface of the substrate is coated with a back side film which has the same expansion rate as that of the reflective coating layer. Therefore, in the case that the technical solution of claim 13 or 14 does not possess inventiveness, it is obvious for those skilled in the art to obtain the above technical solutions of claims 15, 16 on basis of the cited reference 1, thus claims 15, 16 are not in conformity with Article 22(3) of the Chinese Patent Law for lack of inventiveness.

8. The additional technical feature of claim 17 resides in that "the strong magnetic member is comprised of a hard magnetic body". For the technical solution of claim 17 referring to any one of claims 1, 2, 10, 11, 13-16, since the additional technical feature has been disclosed in the cited reference 1 (refer to the paragraph 13 in the specification of the cited reference 1), in the case that claims 1, 2 do not possess novelty, claim 17 is not in

conformity with Article 22(2) of the Chinese Patent Law for lack of novelty due to citing the technical solution of claim 1 or 2; in the case that claims 10, 11, 13-16 do not possess inventiveness, claim 17 is not in conformity with Article 22(3) of the Chinese Patent Law for lack of inventiveness due to citing the technical solution of any one of claims 10, 11, 13-16.

9. The additional technical features of claim 18 reside in that "further includes: a base and a holding member supported by the base, wherein, the reflection mirror is elastically supported by the holding member". For the technical solution of claim 18 referring to any one of claims 1, 2, 10, 11, 13-17, the cited reference 1 has disclosed that the deformable mirror includes a frame body 13 (corresponding to the base of claim 18), the reflection mirror is directly supported by the frame body 13 and the solenoid magnet 15 (corresponding to the switching device of claim 18) is provided on the frame body. However, in order to ensure that the deformable mirror can be uniformly deformed, it is apparent for those skilled in the art that one holding member can be separately disposed on the frame body to elastically support the deformable mirror. Accordingly, in the case that any one of claims 1, 2, 10, 11, 13-17 does not possess novelty or inventiveness, it is obvious for those skilled in the art to obtain the above technical solution of claim 18 with reference to the cited reference 1, thus claim 18 is not in conformity with Article 22(3) of the Chinese Patent Law for lack of inventiveness.

10. Claim 19 is a dependent claim of claim 18. The additional technical features of claim 19 reside in that "the base is provided with a recessed portion which concaves towards a deforming direction of the reflection mirror, the reflection mirror is supported to cover the recessed portion of the base and contacts with the recessed portion upon deforming under the operation of the switching device in order to hold its deformed state". As apparent from Fig. 1 of the cited reference 1, the frame body 13 and the back cover 14 form one recessed portion together with each other in the middle of the frame body. The deformable mirror 11 is held on the frame body 13 to cover the recessed portion. The paragraph 17 of the cited reference 1 has clearly shown that it is possible to only have one magnetizing plate 13 on the back surface of the deformable mirror 11 and one solenoid magnet in the recessed portion. Therefore, in order to make the mirror 11 have a higher deforming accuracy in the direction directed to the solenoid magnet, those skilled in the art can easily know that one recessed portion is separately disposed on the frame body 12 between the solenoid magnet and the mirror face in a vertical direction and in a portion having no the solenoid magnet in a horizontal direction, so that the mirror 11 is attached on the recessed portion when the mirror deforms towards the recessed portion under a magnetic force. Consequently, in the case that the technical solution of claim 18 does not possess inventiveness, it is obvious for those skilled in the art to obtain the above technical solution of claim 19 in respect of the cited reference 1, thus claim 19 is not in conformity with Article 22(3) of the Chinese Patent Law for lack of inventiveness.

11. Claim 20 is a dependent claim of claim 19. The additional technical features of claim 20 reside in that "the reflection mirror has an approximately oval shape, the recessed portion of the base is made to have a substantially oval shape corresponding to the shape of the reflection mirror". The deformable reflection mirror is used for reflecting a light in an optical instrument (refer to the paragraph 1 in the specification of the cited reference 1). A light beam emitted by a semiconductor laser source which is commonly applied in the optical instrument has an oval shape in a cross section. Accordingly, it is easily obtained for those skilled in the art that a reflection mirror for reflecting the light beam is correspondingly designed to have an oval shape and the recessed portion of the base is correspondingly designed to have an oval shape. In the case that claim 19 does not possess inventiveness, it is obvious for those skilled in the art to obtain the above technical solution of claim 20 with reference to the cited reference 1, thus claim 20 is not in conformity with Article 22(3) of the Chinese Patent Law for lack of inventiveness.

12. Claim 21 is a dependent claim of any one of claims 18 to 20. The additional technical feature of claim 21 resides in that "the holding member presses the reflection mirror against the base by means of an elastic force". It is easily anticipated for those skilled in the art that a structure of the holding member is designed to have the elastic force for pressing the reflection mirror against the base. Therefore, in the case that the technical solution of any one of claims 18-20 does not possess inventiveness, it is obvious for those skilled in the art to obtain the above technical solution of claim 21 with reference to the cited reference 1, thus claim 21 is not in conformity with Article 22(3) of the Chinese Patent Law for lack of inventiveness.

13. Claim 22 is a dependent claim of claim 21. The additional technical features of claim 22 reside in that "the holding member includes a base portion assembled in the base, a spring leaf extending from the base portion, and a pressing frame which is connected to the spring leaf and tightly pressed on the reflection mirror". The technical solution of claim 21 does not possess inventiveness. The holding member should have functions for holding the deformable mirror and pressing the reflection mirror against the base by means of the elastic force, so that it is easily appreciated for those skilled in the art that the structure of the holding member is designed to include the base portion assembled in the base, the spring leaf extending from the base portion, and the frame which is connected to the spring leaf and tightly pressed on the reflection mirror. Therefore, it is obvious for those skilled in the art to obtain the above technical solution of claim 22 in respect of the cited reference 1, thus claim 21 is not in conformity with Article 22(3) of the Chinese Patent Law for lack of inventiveness.

14. Claim 23 is a dependent claim of any one of claims 18 to 20. The additional technical feature of claim 23 resides in that "the holding member is comprised of an elastic



adhesive". It is easily anticipated for those skilled in the art that the elastic adhesive can facilitate to achieve the holding member having the elastically supporting function. Therefore, in the case that the technical solution of any one of claims 18-20 does not possess inventiveness, it is obvious for those skilled in the art to obtain the above technical solution of claim 23 with reference to the cited reference 1, thus claim 23 is not in conformity with Article 22(3) of the Chinese Patent Law for lack of inventiveness.

15. Claim 24 seeks to protect an optical head which includes the deformable mirror in accordance with any one of claims 1 to 23. Claim 24 differs from aforementioned technical solutions of claims 1, 2, 10, 11, 13-23 in that: the deformable mirror is applied in the optical head, the optical head is used to condense the light onto a light information recording medium, the optical head includes an object lens for condensing the light onto the light information recording medium and an object lens actuating device for driving the object lens, wherein the deformable mirror is provided for reflecting the light emitted by a light source to the object lens. The cited reference 2 (JP 特开 2003-67969A) has disclosed an optical head (refer to the paragraphs 4, 10-17 in the specification of the cited reference 2, see Fig. 1 and 7). A reflection mirror of the optical head is a deformable mirror 6. The optical head is used to focus the light on a recording medium 8. The optical head includes an object lens 7 for focusing which is driven in parallel with the recording medium 8. The optical head thus must include an object lens driving device for driving the object lens 7, wherein the deformable mirror 6 is used to reflect the light emitted by the light source to the object lens 7. Thereby, the above differences have been disclosed in the cited reference 2. As such, claim 24 and the cited reference 2 have the same effect so that both of them is for the purpose of achieving a device adapting to read the recording medium with different thicknesses. Accordingly, the cited reference 2 has suggested that the above technical features are applied in the cited reference 2 to solve its technical problems. Therefore, in the case that the technical solution of any one of claims 1, 2, 10, 11, 13-23 does not possess novelty or inventiveness, it is obvious for those skilled in the art to obtain the above technical solution of claim 24 in respect of the cited reference 1, thus claim 24 has no substantive features and represents progress, which is not in conformity with Article 22(3) of the Chinese Patent Law for lack of inventiveness.

16. Claim 25 is a dependent claim of claim 24. The additional technical feature of claim 25 resides in that "the deformable mirror is disposed in a space below the object lens actuating device". However, it is a well known technique for those skilled in the art that the reflection mirror is disposed in the space below the object lens actuating device. Therefore, in the case that the technical solution of claim 24 does not possess inventiveness, it is obvious for those skilled in the art to obtain the above technical solution of claim 25 with reference to the cited references 1 and 2, thus claim 25 is not in conformity with Article 22(3) of the Chinese Patent Law for lack of inventiveness.

17. Claim 26 seeks to protect a light recording/reproducing device which includes the optical head in accordance with claim 24 or 25. Claim 26 differs from claims 24, 25 in that: the optical head is applied in the light recording/reproducing device, the light recording/reproducing device is used to condense the light onto a light recording/reproducing medium provided with double recording layers and performs at least one of recordation and reproduction of the information in the light recording/reproducing medium, the light recording/reproducing device includes a power supply portion which supplies an electric power required for switching the states of the reflection mirror to the optical head. The cited reference 2 has disclosed a light recording/reproducing device (refer to the paragraphs 1, 4, 10-19 in the specification of the cited reference 2, see Fig. 1, 7 and 10). The device is used to focus the light on the information recording medium with different thicknesses and records and produces in the information recording medium. The device includes an optical head 1 and a power supply portion 412 which supplies the electric power required for switching the deformed state of the reflection mirror to the optical head 1. Thereby, the cited reference 2 has disclosed the technical features "the optical head is applied in the light recording/reproducing device, the light recording/reproducing device is used to condense the light onto a light recording/reproducing medium provided with double recording layers and performs at least one of recordation and reproduction of the information in the light recording/reproducing medium, the light recording/reproducing device includes a power supply portion which supplies an electric power required for switching the states of the reflection mirror to the optical head". Claim 26 and the cited reference 2 have the same effect that both of them are for the purpose of achieving a device which can read the recording medium having a cover layer with different thicknesses (i.e., the distances between a light incident plane and recording layers are different). Consequently, the cited reference 2 has suggested that the above technical features are applied in the cited reference 1 to solve its technical problems. It is easily appreciated by those skilled in the art without any inventive steps that aforementioned device is used to record and produce in the light recording/reproducing medium provided with double recording layers (i.e., each recording layer has a different distance from the light incident plane). Therefore, in the case that claims 24, 25 do not possess inventiveness, it is obvious for those skilled in the art to obtain the technical solution of claim 26 in respect of the cited references 1 and 2, thus claim 26 is not in conformity with Article 22(3) of the Chinese Patent Law for lack of inventiveness.

18. Claim 27 is a dependent claim of claim 26. The additional technical features of claim 27 reside in that "when condensing on a first recording layer away from the light incident plane, the reflection mirror is a flat mirror; and when condensing on a second recording layer close to the light incident plane, the reflection mirror is deformed into a concave mirror having the reflecting surface with a concave shape". The reflection mirror 6

has flat and concave states in the cited reference 2 (refer to the paragraph 17 in the specification of the cited reference 2), as apparent from Fig. 7, the focus point of the focused beam is farther in the flat state than that in the concave state. Accordingly, the cited reference 2 has disclosed the technical features "when condensing on a first recording layer away from the light incident plane, the reflection mirror is a flat mirror; and when condensing on a second recording layer close to the light incident plane, the reflection mirror is deformed into a concave mirror having the reflecting surface with a concave shape". Claim 27 and the cited reference 2 have the same effect on focusing on the planes at different distances. Consequently, the cited reference 2 has suggested that the above technical features are applied in the cited reference 1 to solve its technical problems. It is easily anticipated by those skilled in the art without affording creative labor by using above features of the deformable mirror that: when the reflection mirror is the flat mirror, the light beam is condensed on the first recording layer away from the light incident plane; and when the reflection mirror is the concave mirror, the light beam is condensed on the second recording layer close to the light incident plane. Therefore, in the case that claim 26 does not possess inventiveness, it is obvious for those skilled in the art to obtain the above technical solution of claim 27 with reference to the cited references 1 and 2, thus claim 27 is not in conformity with Article 22(3) of the Chinese Patent Law for lack of inventiveness.

19. Claim 28 is a dependent claim of claim 26 or 27. The additional technical feature of claim 28 resides in that "the power supply portion applies a pulse voltage only when switching the above states of the reflection mirror". However, it is easily appreciated by those skilled in the art that the switching of the deformed state of the reflection mirror can be achieved only by applying a common pulse voltage. Therefore, in the case that claim 26 or 27 does not possess inventiveness, it is obvious for those skilled in the art to obtain the above technical solution of claim 28 with reference to the cited references 1 and 2, thus claim 28 is not in conformity with Article 22(3) of the Chinese Patent Law for lack of inventiveness.

(2) Claims 3, 5, 24 and 26 are not in conformity with Article 31(1) of the Chinese Patent Law for lack of unity.

Based on above-mentioned content disclosed in the cited references 1 and 2, the specific technical feature of claim 3 resides in that: the magnetizing member includes a yoke and a secondary coil. The technical solution of the independent claim 5, those technical solutions not including the specific technical feature of claim 3 in the independent claim 24 and those technical solutions not including the specific technical feature of claim 3 in the independent claim 26 do not comprise the same or corresponding technical feature with the specific technical feature of claim 3. Accordingly, aforementioned claims and claim 3 are not technically interrelated and do not belong to a single general inventive concept, which is not

in conformity with Article 31(1) of the Chinese Patent Law. Therefore, concerning claim 3 which is likely to be granted, the applicant should delete or amend other claims lack of unity to overcome above defects. For the deleted ones, the applicant may file one or more divisional applications for them at any time before the present application is issued.

***Article 31(1): An application for a patent for invention or utility model shall be limited to one invention or utility model. Two or more inventions or utility models belonging to a single general inventive concept may be filed as one application.***

(3) Other issues.

1. Claim 4 includes the technical features “the secondary coil and at least a portion of the yoke are disposed on the back surface and the side surface of the reflection mirror”. It is not clear for those skilled in the art which of the secondary coil and at least a portion of the yoke is disposed on the back surface of the reflection mirror; and which of the secondary coil and at least a portion of the yoke is disposed on the side surface of the reflection mirror, thereby resulting in the protect scope of claim 4 not clear, which is not in conformity with Rule 20(1) of the Implementing Regulations of the Chinese Patent Law being quoted below.

***Rule 20(1): The claims shall define clearly and concisely the matter for which protection is sought in terms of the technical features of the invention or utility model.***

2. The meanings of the terms “approximately ” and “substantially” included in claim 20 are not clear, thereby resulting in the protect scope of claim 20 not clear, which is not in conformity with Rule 20(1) of the Implementing Regulations of the Chinese Patent Law.

3. Claim 10 is a multiple dependent claim referring to the preceding multiple dependent 9, which is not in conformity with Rule 23(2) of the Implementing Regulations of the Chinese Patent Law.

Claims 11-13, 15-18, 21, 23 also have the same problem, which is not in conformity with Rule 23(2) of the Implementing Regulations of the Chinese Patent Law being quoted below.

***Rule 23(2): A dependent claim shall refer only to the preceding claim or claims. A multiple dependent claim referring to two or more preceding claims shall only refer to any one of the preceding claims, and shall not be taken as the basis of any multiple dependent claim.***



## **CONCLUSION**

Concerning the above, this application shall not be granted until now. The applicant should file a new specification and claims within the designated period of this notification. In particular, please note that the amended claims shall have unity and be in conformity with Article 33 of the Chinese Patent Law being cited below, and shall not go beyond the initial scope of the claims and specification. Please note the amending bases in detail.

*Article 33 An applicant may amend his or its application for a patent, but the amendment to the application for a patent for invention or utility model may not go beyond the scope of the disclosure contained in the initial description and claims, and the amendment to the application for a patent for design may not go beyond the scope of the disclosure as shown in the initial drawings or photographs.*